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ABSTRACT

This study examines two questions: (1) are the natural environmental contingencies under which reflective and impulsive children operate different? and (2) if so, which, if any of these differences, predict the nature of behavior change? Forty impulsive and reflective children and their mothers were observed while solving discrimination problems together. After the interaction session the children were administered forms of the Matching Familiar Figures Test (MFFT) and the mothers completed a questionnaire probing their perceptions of the interaction session. Interaction patterns were found to differ as a function of a) the match in cognitive tempo between mother and child (i.e. mother-reflective, child impulsive and vice versa); b) the sex of the child; and c) whether mothers' responses to their children served as antecedents or consequents. It was suggested that mothers use impulse control initially to change behavior in the reflective direction but then follow this with strategy instruction in order to maintain reflective behavior. Impulsive mothers of impulsive children were found to let their children control the interaction session. Mothers' subjective perceptions of their own behavior and that of their child's differed markedly from the observational data. (Author/MP)

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Natural Determinants of Change in Cognitive Tempo

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Parts of this paper were presented at the Biennial Meeting of the Society for Research in Child Development, San Francisco, 1979. Reprints may be obtained from M.K. McKim, Department of Family Studies, University of Guelph, Guelph, Ontario, Canada, N1G 2W1

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ABSTRACT

Forty impulsive and reflective children and their mothers were observed while solving discrimination problems together. After the interaction session the children were given a second form of the MFFT and the mothers completed a questionnaire probing their perceptions of the interaction session. Interaction patterns were found to differ as a function of a) the match in tempo between mother and child, b) the sex of the child and c) whether responses served as antecedents or consequents. It was suggested that mothers use impulse control initially to change behavior in the reflective direction but then follow this with strategy instruction in order to maintain reflective behavior. Impulsive mothers of impulsive children were found to let their children control the interaction session. Mothers' subjective perceptions of their own behavior and that of their child's differed markedly from the observational data.

Determinants of Change in Cognitive Tempo

Research has indicated that reflective children generally are more successful in school than impulsive children (eg. Kagan, 1965; Messer, 1970; Barrett, 1977). Presumably as a result of these findings many investigators have been interested in finding out whether impulsive children can be trained to become more reflective. Techniques such as verbal instruction (eg. Seggev, 1972), modelling (eg. Denney, 1972), direct reinforcement (eg. Briggs and Weinberg, 1973), task manipulation (eg. Zelniker and Oppenheimer, 1973) and combinations of these methods (eg. Meichenbaum and Goodman, 1971) have been employed. Despite this considerable effort, modification studies have not only often failed to produce persistent behavior change (Debus, 1970; Egeland, 1974; Ridberg, Parke and Hetherington, 1974) but what changes have been observed frequently have not generalized to tasks which differ from the training task (Ayabe, 1969; Butter, 1972; Meichenbaum and Goodman, 1971; Schwab, 1973; Seggev, 1972; Zelniker, Jeffery, Ault and Parsons, 1972). These rather discouraging findings taken together with the well known fact that all children become more reflective as they get older prompted the questions addressed in the present research. Are the natural environmental contingencies under which reflective and impulsive children operate different? If so, which if any of these differences predict the nature of behavior change?

Surprisingly only one study involving direct observation of impulsive and reflective children has been reported. Campbell (1973) observed mother-son pairs while they were engaged in two nonverbal and two verbal tasks where one problem of each type was difficult and the other easy. It was

found that mothers of reflective boys gave more direct physical help and made more specific suggestions about task solution than mothers of impulsive boys. Further, reflective boys made more comments while performing the difficult verbal task than their impulsive peers. Campbell's (1973) research leaves a number of important issues unresolved. First, Yando and Kagan (1968) have demonstrated that the cognitive tempos of children vary as a function of the tempos of the teachers to whom they are exposed. Moreover, Matekunas (1972) has reported that while the MFFT response times of mothers and sons are positively related the correlation between the error scores of these two groups is not significant. Together these findings suggest that, a) the cognitive tempos of both mother and child may play active roles in determining the nature of their interactions, and b) the match between the reflection-impulsivity status of mothers and their children may affect their interactions. For example, mother-child pairs whose tempos do not match (i.e. mother-reflective, child impulsive and vice versa) may show more evidence of conflict (eg. less non compliance on the part of the child and more impulse control statements by the mother) than mother-child pairs whose tempos do match (i.e. mother and child both reflective or both impulsive).

Second, observed assymetries in the response of males and females to tempo modification attempts (Debus, 1970; Yando and Kagan, 1968) may be an indication that the environmental contingencies which control reflection-impulsivity are sex dependent. The fact that Cherry and Lewis (1976) have shown that mothers of daughters are more verbally responsive than mothers of sons provides further support for this hypothesis. Campbell's (1973) exclusive observation of mother-son pairs precluded assessment of this

possibility.

Third, differential patterns of parent-child interactions must have predictive validity if this information is to serve more than purely descriptive purposes. It is quite possible that reflective and impulsive children react to their environments in many different ways. However some of these differences may be more critical than others when it comes to predicting differences in task performance. Campbell (1973) did not assess the relationship between the task performance of impulsive and reflective boys and the observed mother-child interaction patterns. Thus it is impossible to tell whether the greater task structuring imposed by reflective mothers resulted in later improved performance.

Fourth, most studies of parent-child interaction have been interpreted in terms of either the effects of the parent on the child's behavior (eg. Campbell, 1973) or more recently, the effects of the child on the parent's behavior (Bell and Harper, 1977). However, there is no doubt that during any dyadic interaction sequence the behavior of each participant continuously effects the behavior of the other. Only an observational procedure where all behaviors are recorded in relation to specified antecedent and consequent events allows assessment of this dynamic feature of interaction sequences, (Mash, 1973). In the present research the aim of identifying the natural environmental contingencies which control cognitive tempo was achieved through application of this functional analytic method.

Finally, there is no doubt that objective observational data must play an integral yet incomplete role in our understanding of the parent-child interactive process. The parents' as well as the child's perceptions

of interactions must be considered important sources of information. In the current study then, mothers were given a questionnaire immediately following the interaction session. In this way the mothers subjective perceptions of the interaction could be examined separately and in relation to the objective observations.

METHOD

Subjects

From an initial sample of 139 Grade 3 and 4 middle-class suburban children (mean age 8.80 years), 20 reflective (10 males, 10 females) and 20 impulsive (10 males, 10 females) children and their mothers were selected. For comparability to previous research, this sample was selected by applying the double median split criterion to the children's MFFT (form F) total error and mean response time data ($r = -.65$). However a single, composite, reflection-impulsivity score was created for each subject and used in all subsequent analyses. This composite score (DIF 1) was derived by taking the difference between standardized MFFT (form F) total error and mean latency scores. With this procedure the traditional median split criterion for distinguishing between reflectives and impulsives is maintained since reflectives scores (mean, -1.69; SD, 1.26) do not overlap those of impulsives (mean, 1.79; SD, 0.93) and fast-accurate and slow-inaccurate subjects scores centre around zero. Further the continuous nature of the reflective-impulsive dimension is maintained allowing for differentiation of subjects in terms of their degree of reflectivity. A similar procedure was used to construct a single, composite index, DIF2, representing the children's performance on Form S of the MFFT given as a posttest.

The mothers of the 40 selected children were individually administered the adult form of the MFFT just before the mother-child interaction session. Since the mothers were not a random sample of adults but were selected on the basis of their children's MFFT performance and their willingness to participate in the study, application of the double median split criterion was not considered appropriate. However a standardized composite difference score (DIFM) was constructed and used as an estimate of the mothers' reflection-impulsivity status in all analyses of interaction data. As expected though, the mothers' MFFT response times (mean 54.70 seconds) were significantly longer than those obtained by their children (mean 13.26 seconds) but the mean total errors of these two groups were comparable (mothers 8.58; children, 8.83). It must be remembered though that the children were given a different form of the MFFT than the mothers.

Procedure

Mother-child dyads arrived at the University two to four months after the children had been given the MFFT (Form F) at school. They were told that the purpose of the study was "to understand how parents and children alone and together go about solving problems". While the mother was given the adult form of the MFFT the children performed eight, 16-trial, simultaneous, discrimination problems alone. The blank-trials procedure developed by Levine (1966, 1969, 1975) for use with adults and employed successfully with children by numerous researchers (eg. Gholson and Danziger, 1975) was the procedure used here.¹ Then the children watched a cartoon and their mothers worked on the same set of discrimination problems. Thus, when the interaction session began both the mothers and

the children had had exactly the same problem solving experience. While working together on a set of eight new discrimination problems, the mothers sat to the right of their children and the stimulus display box. Each dyad was instructed "to work together on the problems as you would if you were doing something together at home." After the interaction session the mothers completed a questionnaire concerning the preceding interaction session and the children were given a second form of the MFFT (Form S). The questionnaire included 14 items designed to parallel the behavior categories used by the observers. A 7-point Likert scale was used.

Data Analysis

Videotapes of each mother-child interaction session were coded by two observers. The observation procedure was derived from the response-class matrix technique described by Mash (1973). This technique makes possible the recording of particular behaviors in relation to specified antecedent and consequent events in the environment using two observation matrices simultaneously. The first matrix is the Child's Consequent Behavior Record with nine possible antecedent mother behaviors as row headings and nine possible child consequent behaviors as column headings. The second matrix is the Mother's Consequent Behavior Record arranged so that the row and column headings of matrix 1 are reversed, (i.e. antecedent child behaviors and consequent maternal behaviors). A time-sampling observation method was employed. Each observer recorded an observation in one of the cells of matrix 1 or 2 after 10 seconds. Only the first behavior unit to occur in the ten-second interval was recorded. Definitions of the mother and child behaviors included in the observation matrices are

listed below.

Maternal Response Classes

Indirect Help. Statements which did not suggest a particular response or solution to the problem but took the form of a general strategy suggestion or list of alternate solutions. For example, "We can try one of the sizes or positions."

Question. Scored in this category were any direct questions not of the command-question type. For example, "What were you going to do?"

Praise. This category included both verbal statements and nonverbal actions indicating encouragement, acceptance, and/or approval of the child's behavior.

Neutral. Any general statement about the task or the child's behavior that did not have strong emotional overtones but expressed interest or attention. For example "mm hmm".

Negative. Verbal statements and nonverbal actions indicating discouragement, non-acceptance, and/or disapproval of the child's behavior. For example, "No, you're wrong."

Direct help. Direct help was scored only when the mother actually responded for the child or specifically told the child which stimulus to pick. For example, "Push the black one".

Impulse Control. Any statement aimed at inhibiting the child's immediate behavior. Impulse control most frequently took the form of controlling response times (slower or faster). For example, "Wait".

Conclusion. Any statement made in a semi-logical form (often negative) which implied that the subject had decided on a tentative solution to the problem. For example, "It can't be black".

No response. No response was scored when during the 10 second interval the subject made no task related responses. For example, "Do up your shoelaces."

Child Response Classes

The categories of Impulse Control, Conclusion, Negative and No Response for the child paralleled those defined as maternal response classes. Five other response types were specific to the child however.

Compliance. Compliance was scored when the child's behavior was in response to the mother's Direct Help or Impulse Control statement. Any response ranging from approximation to full compliance was classified as compliance.

Independent Responding. This was scored when the child was responding to the stimuli on his/her own and not interacting with the mother.

Task Suggestion. Any statement made by the child in which a suggestion concerning a particular solution or a general strategy was made. An example is, "I think we should try black."

Interaction. Interaction was an attempt to initiate or maintain some type of mutual contact and included asking or answering questions.

Comments. Any statement made by the child obviously not directed to the mother. Comments took precedence over No Response. They were primarily self-evaluative in nature.

Ten percent of the interaction sessions were coded twice by each of two observers who in their training had previously reached a reliable mean 90 percent agreement. Agreement was scored only if both observers had the same observation number in the appropriate response category. Tapes selected for reliability checks were selected randomly without the knowledge

of the observer who had done the original coding. Mean percent agreements ranged from 78 to 100 with a mean of 85.71. Unless otherwise noted, multivariate analysis of variance followed by examination of significant univariate tests associated with obtained multivariate effects was the method of analysis. All analyses were conducted on the absolute frequency with which behaviors occurred.

RESULTS

In order to determine whether the additional effort of the two observer system could be justified in practice as well as theory, the frequencies with which behavior categories were used in initiating rather than responding to interaction were examined. Multivariate profile analyses (McCall and Appelbaum, 1973) revealed that mothers and children were different when responding to interaction initiated by the other member of the dyad (consequent behavior) than they were when they themselves initiated contact (antecedent behavior). For this reason the Child and Mother Consequent Behavior Records (Matrix 1 and 2) were analyzed separately.

The major differences found in interaction patterns were attributable to the match between mother and child tempos and/or the sex of the child. For example, male impulsives with impulsive mothers made the most Conclusions about task solution while female reflectives with reflective mothers made the least number of Conclusions ($F_{1,36} = 6.72, p < .013$). Further, children whose tempos matched their mothers' (both mother and child reflective or both impulsive) responded Independently more often than children whose tempos did not match their mothers' ($F_{1,37} = 4.59, p < .037$). With respect to sex differences, mothers were more likely to

praise their sons than their daughters and sons were more likely to respond to their mothers' questions than were daughters ($F_{1,38} = 4.57$, $p < .038$).

The reflective-impulsive status of the mothers also played a significant role. Reflective mothers gave more Indirect Help than impulsive mothers ($F_{1,37} = 7.11$, $p < .011$) and were less likely to have their behavior classified in the No Response category than impulsive mothers ($F_{1,37} = 6.89$, $p < .012$). Regardless of their own reflective-impulsive status, children with reflective mothers made more Task Suggestions than children with impulsive mothers ($F_{1,37} = 7.26$, $p < .010$).

Another important factor accounting for variability in interaction patterns was the child's tempo. Mothers of reflective children (regardless of their own tempo) made more Conclusions than mothers of impulsive children ($F_{1,37} = 4.73$, $p < .034$). Presumably mothers responded with Conclusions when their children made few and vice versa, apparently balancing out the total number of Conclusions made by the pairs as units. While there were no group differences with respect to the number of Impulse Control statements made to the mother by the child, there was a difference in the extent to which the mothers complied with these attempts at controlling her behavior, ($F_{1,36} = 8.14$, $p < .007$). Mothers were most likely to comply if their child was an impulsive son and least likely to comply if their child was a reflective son.

Since the majority of the questions asked of the mothers immediately following the Interaction session correspond to behavior categories in the observational schedule, the results of the questionnaire analysis will be presented with reference to the preceding findings. In general, the

mothers' perceptions of the session were quite different from what was observed. For example, while there were no group differences in the analysis of the extent to which mother's interrupted their children when they were working independently, mothers of impulsive children reported that they interrupted more frequently than mothers of reflective children ($F_{1,37} = 5.249, p < .026$). Further, in the analysis of observational data it was found that mothers with sons praised more often than mothers with daughters. Conversely, the mothers of reflective sons or impulsive daughters reported they showed more approval following compliance than mothers of reflective daughters or impulsive sons, ($F_{1,36} = 8.27, p < .007$). There were no group differences observed in the extent to which children complied to specific maternal suggestions. However, mothers reported differences. Impulsive mothers reported that their impulsive sons almost never complied to their task suggestions while mothers whose daughters' tempo matched their own said their children almost always complied ($F_{1,36} = 4.77, p < .034$). These last two effects have been depicted in Figure 1. In a comparison between observed and reported lack of interest

Insert Figure 1 about here

in the task, it was found that while impulsive mothers were observed to use the No Response category more often than reflective mothers, the mothers with daughters reported that their interest lagged more often than mothers of sons ($F_{1,38} = 5.54, p < .023$). The apparent greater interest in sons may be the reason for the observed higher degree of praise given to sons. While there were other behavior categories on which subject groups

were observed to differ there were no further differences in the mothers' reports of the Interaction session.

An analysis of change in the children's standardized reflective-impulsive status revealed that initially impulsive children changed the most and in the reflective direction ($F_{1,37} = 22.83, p < .001$). At the point in stepwise regression where a maximum of variability in the change in reflective-impulsive status variable was accounted for by the fewest number of Matrix 1 mother-child interaction variables, the regression equation accounted for 50 percent of the change ($F_{11,28} = 2.55, p < .05$). The impulsive children who changed most in the reflective direction were the ones whose mothers had; a) given the least Indirect Help and b) been most involved in the task. In response to their mothers, children who became more reflective a) answered more questions, b) were more involved in the task, c) used more Negative responses and d) directed more Impulse Control statements to the mother. In relation to the Matrix 2 interaction variables, the regression equation accounted for 57.5 percent of the variance in tempo change ($F_{10,29} = 3.96, p < .01$). Children who changed their status most in the reflective direction used as antecedents; a) fewer Comments and b) more Negatives. Further, these same children had mothers who responded to them with a) more Impulse Control statements, b) more Questions, c) fewer Negatives and d) fewer Conclusions.

DISCUSSION

Consistent with previous findings associating a global, quick decision, information processing mode with impulsivity, (Zelniker and Jeffrey, 1976), the impulsive children in this study (particularly impulsive sons with impulsive mothers) made the most number of conclusions

about problem solutions. These children continually made premature solution decisions. Moreover, impulsive mothers with impulsive children generally let their children control the interaction session. More than other groups these mothers most frequently complied to their impulsive sons attempts at controlling their behavior. Further, children with impulsive mothers made more task suggestions and impulsive mothers were least likely to initiate task relevant interaction. This picture of impulsive mothers suggests why their children do not readily become more reflective.

The numerous differences in interaction patterns attributable to sex differences, or sex by tempo match interactions, deserve comment. More praise was given to sons than to daughters, and sons were more likely to answer questions than daughters. Further, reflective females with reflective mothers were less likely to make conclusions about problem solutions than impulsive males with impulsive mothers. These differences and subsequent sex and tempo match differences in the mothers perceptions of the interaction session clearly indicate that mothers and sons have a different relationship than mothers and daughters. Further study may reveal that comparable, but reversed, sex and tempo-match relationships exist between fathers and sons and fathers and daughters. The tempo of the father also seems the most plausible reason why some children's tempos matched their mother's, while other children's did not. This interpretation would predict that children whose parents' tempos do not match (eg. father reflective - mother impulsive or father impulsive - mother reflective) are the same children whose tempos are unlikely to match their mothers.² This hypothesis is indirectly supported by the fact that the overall correlation

between the reflective-impulsive status of children and mother is frequently not a significant one. Why children with mismatched parents should be more like one than the other is not understood. It could be attributable to the relative amounts of time the mother and father spend with the child, and/or, due to some predisposition of the child's.

The behavior categories of impulse control, direct help and indirect help used in this study were all related to previous methods used to try and modify tempos experimentally. That is, the impulse control category was most like required delay techniques, while direct help more closely approximated the modelling studies and indirect help related to the scanning and strategy instruction methods. The finding that reflective mothers used the latter approach more frequently than impulsive mothers, together with the result that reflective mothers were more likely to have their impulsive children show the most change in the reflective direction, would tend to support the notion that strategy instruction is an effective method of modifying cognitive tempos. However, the direct analysis of the relationship between mother-child interaction patterns and subsequent change in reflective-impulsive status, contradicts this conclusion. Paradoxically, the children who changed the most had mothers who responded to them with the most impulse control statements during the interaction. In conjunction with the above findings, this suggests that mothers do different things when attempting to modify behavior in the reflective direction than they do when maintaining a reflective approach in their children. This implies that the use of impulse control followed by strategy instruction would most effectively change and then maintain reflectivity. It should be noted, however, that the children whose status

changed were highly involved in the task and showed considerable concern about making mistakes.

It is perhaps surprising that the mothers were essentially unaware of the ways in which their own behavior and that of their children differed from other mother-child pairs. This finding supports the contention that actual and perceived behaviors must be treated as two separate but equally important perspectives on the interactive process. Certainly we must conclude that if parents are to modify the behavior of their children they must first be cognizant of the way they interact with them now.

The most pervasive effect obtained in this study provides strong evidence for the role of natural environmental contingencies in determining cognitive tempos. Not only was the tempo of both mother and child an important factor accounting for differences in interaction patterns, but the match in tempos was also an important variable in determining the extent of subsequent changes in performance. Training parents to be more aware of and to modify their own behavior toward their children could prove an effective method of modifying tempos.

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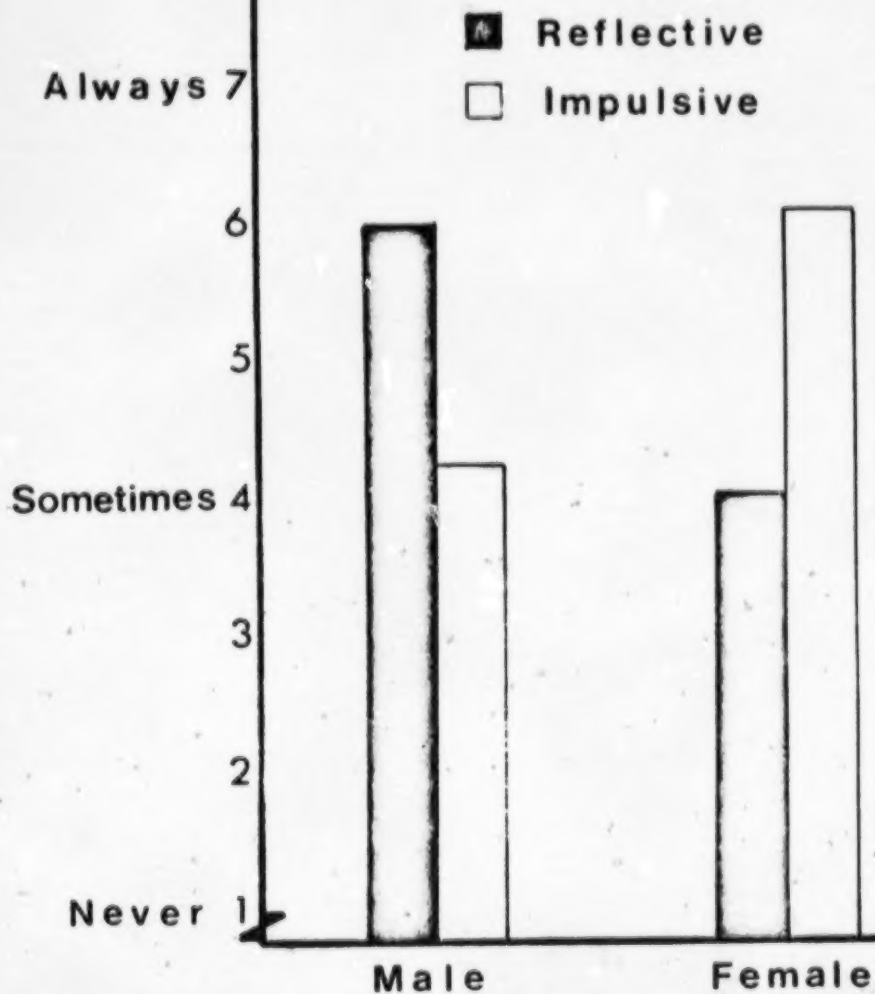
Footnotes

1. A detailed description of the discrimination problems and the method of analyzing problem-solving efficiency and strategies is available from the author on request.
2. In fact, preliminary analysis of a study allowing examination of family tempo relationships provides support for this conjecture.

Figure Caption

Figure 1. Mother's response to Questionnaire on Interaction Session.

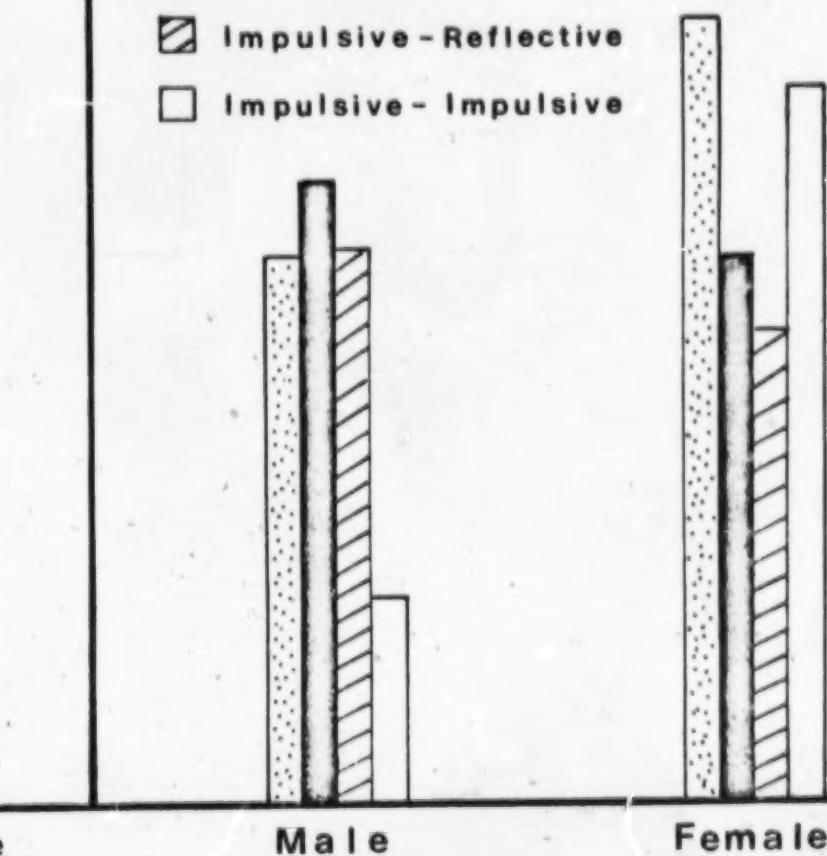
"When your child did something you asked, did you show your approval (verbally or nonverbally)?"



"Did your child accept and act upon your specific suggestions re: solving the problem?"

CHILD MOTHER

- Reflective - Reflective (Dotted pattern)
- Reflective - Impulsive (Solid black)
- Impulsive - Reflective (Diagonal lines)
- Impulsive - Impulsive (White)



CHILD

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